## Project Details

**ROSES ID:** NRA-NNH04ZSS001N
**Selection Year:** 2005
**Program Element:** Focused Science Topic

**Topic:** Solar-energetic particles origin at the sun and inner heliosphere

**Project Title:**
Energetic Particles and the Earth's Environment in Space

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**Summary:**
Energetic particles are one of the most-important elements of the Earth's environment in space. Large increases in the flux of energetic particles reaching the Earth may pose serious threat to technology such as satellites and other parts of the human environment in space. This proposal seeks three years of support for a program of detailed numerical modeling and theoretical studies to understand, model, and predict large solar particle events (SEPs). We propose to develop and apply tools to simulate the acceleration of energetic particles at CME (Coronal Mass Ejection) driven shocks and their subsequent transport to the Earth in realistic CME models. We are already combining our SEP acceleration and transport codes to realistic CME simulations of other groups with encouraging results, and intend to continue and extend this work. Our code follows magnetic field lines as they evolve thus is suitable for handling the complex and time-varying configurations of realistic CMEs. We have the capability to work with other groups and incorporate their different CME models into our code. We intend to make our code accessible for the community. Theoretical studies will be continued to clarify the injection mechanism which is one of the most important processes in producing SEPs, and is still poorly understood. Also, we will study the role which cross-field diffusion plays in the process and incorporate it into our codes. Specifically we propose: - Full coupling between realistic CME simulation and our SEP codes. - Using CME simulations as input to our SEP code, implying partial, infrequent coupling with large time steps. - Study test cases to isolate and identify the role of different processes - Continue theoretical research addressing the injection problem, and explore the efficiency of quasi-perpendicular shocks. We shall use hybrid simulations and particle pushing techniques. - Address the role cross-field diffusion plays in the transport of SEP from the Sun to the Earth, and incorporate cross-field transport into our codes.

## Publication References:

**Summary:** no summary

**Reference:** Kóta, J.; Manchester, W. B.; Jokipii, J. R.; de Zeeuw, D. L.; Gombosi, T. I.; (2005), Simulation of SEP Acceleration and Transport at CME-driven Shocks, THE PHYSICS OF COLLISIONLESS SHOCKS: 4th Annual IGPP International Astrophysics Conference. AIP Conference Proceedings, Volume 781, pp. 201-206, doi: 10.1063/1.2032697